PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2003-161269

(43)Date of publication of application : 06.06.2003

(51)Int.Cl. F04C 2/10
F04C 15/00
F04C 15/04
F16H 57/02

(21)Application number : 2001-363998

(22)Date of filing : 29.11.2001

(71)Applicant : AISIN AW CO LTD
TOYOTA MOTOR CORP

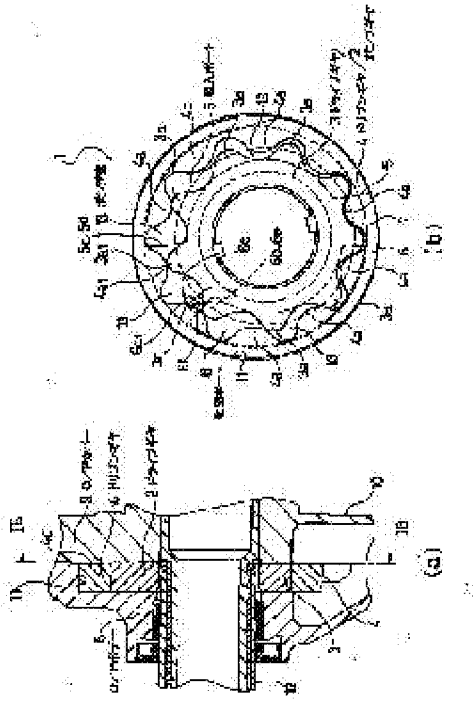
(72)Inventor : MAENO KATSUHIRO
MATSUO AKIRA
KANEDA TOSHIKI
NOZAKI KAZUTOSHI
KASHIWABARA YUJI

(54) GEAR PUMP AND TRANSMISSION USING IT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an inexpensive gear pump with good productivity by minimizing pulsation in discharging and further surely preventing cavitation erosion.

SOLUTION: A body-side discharge port 6a comprises a body-side groove 6c, and a cover-side discharge port comprises a cover-side groove 6f shorter in length than the body-side groove 6c. The whole body of the cover-side groove 6f is axially matched to a part of the body-side groove 6c, and the residual part 6c1 of the body-side groove 6c is not axially matched to the cover-side groove 6f. When both gears 3 and 4 are rotated counterclockwise, a pump chamber 13 communicates with the body-side groove 6c first, and then communicates with the cover-side groove 6f. Since the hydraulic fluid in the pump chamber 13 flows out to the body-side groove 6c and then to the cover- side groove 6f, the flow rate in the body-side groove 6c is large, and bubbles are crushed more in this groove 6c. The flow rate from the pump chamber 13 is gradually increased to moderate pressure gradient, and the pulsation is thus suppressed.



* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]While this invention is used for various hydraulic machinery, belongs to the technical field of the gearbox using the gear pump and this which generate fluid pressure, for example including gearboxes, such as an automatic transmission of a car, and a nonstep variable speed gear, and controlling the pulsation at the time of the regurgitation especially, It belongs to the technical field of the gearbox using the gear pump and this which prevented cavitation erosion more certainly and improved endurance. In this specification, cavitation erosion says the erosion in which a casing is corroded by the cavitation.
[0002]
[Description of the Prior Art]In the automatic transmission of vehicles, such as a car, the automatic transmission which has two or more friction engagement elements which consist of a clutch which engages or stops the planetary gear units and two or more of these rotating elements which have two or more rotating elements, respectively, or a brake is developed variously. Such an automatic transmission performs automatic transmission control by controlling suitably engagement of a friction engagement element, and being un-engaged, and controlling rotation of two or more rotating elements of a planetary gear unit, respectively.
[0003]In that case, although control of engagement of a friction engagement element and not being engaged is performed by the oil pressure controlled by hydraulic control of the automatic transmission according to the vehicle speed or an operating condition, The oil pressure supplied to this hydraulic control is formed with the lubricating oil pump as indicated by JP,11-82644,A etc., for example.
[0004]This lubricating oil pump comprises a gear pump in many cases as indicated by this publication before examination, By the pump gear rotated with the engine of vehicles, this gear pump generates oil pressure, begins supply to hydraulic control as mentioned above, and supplies this oil pressure to each lubricating part of the torque converter of an automatic transmission, and an automatic transmission.
[0005]As shown in drawing 7 (a) and (b), the internal-gear pump which comprises a gear of the couple which that pump gear 2 becomes from the drive gear 3 which has the external tooth 3a of a predetermined number, and the driven gear 4 which has the internal tooth 4a of a predetermined number is used for this gear pump 1. While carrying out eccentricity of the drive gear 3 and the driven gear 4, being provided and a part of the mutual external tooth's 3a and the internal tooth's 4a gearing in the boundary part 7 of the suction port 5 and the discharge port 6, It is allocated in the gear chamber 11 formed in the casing 10 which consists

of the pump body (O/P body) 8 and the pump cover (O/P covering) 9 as it is made for the tooth point end of external-tooth $3a_1$ of an opposite hand and the tooth point end of internal-tooth $4a_1$ to contact mostly about this engage part and center of rotation.

[0006]As shown in drawing 8 (a), the pump body (O/P body) 8 of the casing 10 is formed in peripheral circle shape (the rotation center axis and the same mind of the driven gear 4), Eccentricity is carried out to this pump body (O/P body) 8 from the center of a circular periphery for forming the gear chamber 11, and the crevice 8a of the rotation center axis of the drive gear 3 and a concentric circle configuration is formed. As the body side suction port 5a is located [part / that] in this crevice 8a, while it is provided, as the body side discharge port 6a is located in this crevice 8a, it is similarly established in the pump body (O/P body) 8 in that part.

[0007]On the other hand, as shown in drawing 8 (b), the crevice 9a of the circle configuration into which the pump body (O/P body) 8 fits is formed in the pump cover (O/P covering) 9 of the casing 10. As the covering side suction port 5b is located [part / that] in this crevice 9a, while it is provided, as 6 d of the covering side discharge ports are located in this crevice 9a, they are similarly established in this crevice 9a in that part.

[0008]And when the pump body (O/P body) 8 fits into the crevice 9a of the pump cover (O/P covering) 9, the gear chamber 11 is formed in the crevice 8a of the pump body 8. this time -- the body side suction port 5a -- at least -- drive gear 3 hand of cut -- {-- in drawing 8 (a) -- the great portion of counterclockwise rotation} downstream and the covering side suction port 5b -- the great portion of drive gear 3 hand-of-cut downstream consistenting with shaft orientations substantially (opposite), and at least, the body side discharge port 6a -- at least -- the great portion of drive gear 3 hand-of-cut upstream and 6 d of the covering side discharge ports -- the great portion of drive gear 3 hand-of-cut upstream consistents with shaft orientations substantially at least (opposite).

[0009]Therefore, the position of the hoop direction of the occlusion part 5c in the drive gear 3 hand-of-cut downstream end position of the body side suction port 5a and the position of the hoop direction of the occlusion part 5d in the drive gear 3 hand-of-cut downstream end position of the covering side suction port 5b are in agreement, The position of the hoop direction of the releasing part 6b in the drive gear 3 hand-of-cut upstream end position of the body side discharge port 6a and the position of the hoop direction of the releasing part 6e in the drive gear 3 hand-of-cut upstream end position of 6 d of the covering side discharge ports are in agreement.

[0010]When the drive gear 3 rotates counterclockwise in drawing 7 (b) via the axis of rotation 12 with the driving force of the engine which is a driving source and which is not illustrated and the driven gear 4 also rotates in the direction by rotation of this drive gear 3, the external tooth 3a and the internal tooth 4a which gear mutually change one by one. and, The capacity of the pump room 13 which is formed between each adjoining external tooth 3a of each gears 3 and 4 and 3a and between the adjoining internal tooth 4a and 4a while the periphery of the drive gear 3 and the inner circumference of the driven gear 4, and is open for free passage to the suction port 5 follows on rotation of the drive gear 3 and the driven gear 4, In drawing 7 (b), it increases gradually from the lower right position. And where it inhaled hydraulic oil (equivalent to the hydraulic fluid of this invention) from the suction port 5 and hydraulic oil is inhaled to the maximum extent because the capacity of this pump room 13 increases, If all the pump rooms 13 are located in the drive gear 3 hand-of-cut downstream from the occlusion parts 5c and 5d of the suction port 5, the pump room 13 will be intercepted from the suction port 5.

[0011]The pump room 13 intercepted from the suction port 5 will come to open the pump room 13 for free passage to the discharge port 6, if the drive gear 3 hand-of-cut downstream end of the pump room 13 is located in the drive gear 3 hand-of-cut downstream from the releasing parts 6b and 6e of the discharge port 6 while the capacity decreases gradually. Then, the hydraulic oil of the pump room 13 which was open for free passage to the discharge port 6 flows into the discharge port 6, being pressurized, and also is breathed out from the discharge port 6.

[0012]

[Problem(s) to be Solved by the Invention]By the way, in such a conventional gear pump 1, the hydraulic fluid of the pump room 13 flows into the port 6 comparatively quickly. For this reason, when hydraulic oil flows out of the pump room 13 into the discharge port 6, there is a problem that a pressure gradient becomes large and the pulsation at the time of the regurgitation becomes large.

[0013]In order to prevent the erosion of each member by a cavitation, the thing using the cast iron which has tolerance in the pump body 8 and the pump cover 9 comparatively to cavitation erosion is in the conventional gear pump 1. However, when cast iron is used for both the pump body 8 and the pump cover 9, there is a problem that weight increases.

[0014]An aluminum material is used for the pump body 8 and the pump cover 9, and there are some which prevented cavitation erosion by heat-treating T6 grade to this aluminum material, and increasing the hardness of an aluminum material. However, when such an aluminum material is used, a material cost not only increases, but there is a problem that the tolerance over cavitation erosion is not enough though hardness is increased, and those lives are short. And since it is necessary to heat-treat, the installation cost for it increases, and a man day increases, and the problem of not being good also has productivity.

[0015]In the conventional gear pump 1, in order to prevent the cavitation erosion of an aluminum material, an iron plate is put in between the pump body 8 and the pump cover 9 in many cases. However, when an iron plate is put in in this way, it not only causes the increase of weight of the gear pump 1 by putting in an iron plate further, but discharging performance falls and there is a problem that part mark increase.

[0016]This invention is made in view of such a situation, and the purpose is to provide the gear pump which can make small the pulsation at the time of a pump discharge. Other purposes of this invention are to reduce weight, while preventing cavitation erosion more certainly and improving endurance, and to provide a cheap gear pump with sufficient productivity moreover.

[0017]The purpose of further others of this invention is an automatic transmission or a nonstep variable speed gear, and is providing the gearbox which can reduce weight while improving endurance, and can moreover be manufactured cheaply.

[0018]

[Means for Solving the Problem]In order to solve the above-mentioned technical problem, a gear pump of an invention of claim 1, A suction port, a gear chamber, and a casing in which a discharge port was formed, It has at least a pump gear which consists of a gear of a couple by which it gears to a gear chamber of this casing that it is pivotable respectively and mutually, and is allocated in it, and a pump room is formed in each adjoining interdentium, In a gear pump which inhales hydraulic fluid from said suction port to said pump room because a gear of said couple rotates, and carries out the regurgitation of the hydraulic fluid of said pump room from said discharge port, It is characterized by establishing a flow control means which increases hydraulic fluid of said pump room gradually with a flow of hydraulic fluid which flows into said

discharge port to rotation of a gear of said couple.

[0019]A gear pump of an invention of claim 2 is characterized by comprising a driven gear which has an internal tooth with which a gear of said couple carries out eccentricity, and is provided from a drive gear which has an external tooth, and this drive gear, and gears to said external tooth.

[0020]A gear pump of an invention of claim 3 consists of a pump body and a pump cover which said casing is put together mutually and form said gear chamber, Said discharge port consists of a body side discharge port established in said pump body, and a covering side discharge port established in said pump cover, Said flow control means is provided in either one of said pump body and said pump cover, and is characterized by comprising a slot which is open for free passage to either one of said body side discharge port and said covering side discharge port.

[0021]A gear pump of an invention of claim 4 consists of a pump body and a pump cover which said casing is put together mutually and form said gear chamber, Said discharge port consists of a body side discharge port established in said pump body, and a covering side discharge port established in said pump cover, Said flow control means is provided in both said pump body and said pump cover, respectively, and is characterized by comprising a body sewer which is open for free passage to said body side discharge port and said covering side discharge port, respectively, and a covering sewer.

[0022]A gear pump of an invention of claim 5 is characterized by being set up so that a flow of hydraulic oil of either one of said body sewer and said covering sewer may become larger than a flow of the other of said body sewer and said covering sewer.

[0023]A gear pump of an invention of claim 6 is characterized by both setting up more narrowly than width of said discharge port end each width of said body sewer and said covering sewer.

[0024]A gear pump of an invention of claim 7 said body sewer and said covering sewer, Respectively from a hand-of-cut upstream end of a gear of said couple of said body side discharge port, and said hand-of-cut upstream end of said covering side discharge port. Are provided so that it may extend in said hand-of-cut upstream, and said body side discharge port and said covering side discharge port, the state where said pump body and said pump cover were put together -- those -- it being provided so that a hand-of-cut upstream portion of a gear of said couple may consistent with shaft orientations mutually at least, and, the length of either one of said body sewer and said covering sewer -- either said body sewer and said covering sewer -- it is characterized by being set up shorter than the length of the other.

[0025]A gear pump of an invention of claim 8 either one of said pump body and said pump cover It forms to cavitation erosion by cavitation erosion-proof [high] material, such as comparatively strong tolerant cast iron, either said pump body and said pump cover -- it is characterized by forming another side by cavitation erosion-proof [low] material, such as tolerant comparatively weak aluminum, to cavitation erosion.

[0026]A gear pump of an invention of claim 9 said pump body and said pump cover, . [whether it forms to both cavitation erosion by cavitation erosion-proof / high / material, such as comparatively strong tolerant cast iron, and] Or it is characterized by forming said pump body and said pump cover to both cavitation erosion by cavitation erosion-proof [low] material, such as a tolerant comparatively weak aluminum material.

[0027]A gearbox of an invention of claim 10 controls by hydraulic control oil pressure supplied from a lubricating oil pump in a predetermined size, The feature of said lubricating oil pump comprising a gear pump of any 1 statement of claims 1 thru/or 7 in automatic transmission control or a gearbox which carries

out infinitely variable control and is outputted in driving force from driving sources, such as an engine, with oil pressure from this hydraulic control is carried out.

[0028]

[Function and Effect(s) of the Invention]In the gear pump of an invention of claim 1 thru/or 9 constituted in this way, the flow of the hydraulic fluid which flows into a discharge port comes to increase the hydraulic fluid of a pump room gradually with rotation of the gear of a couple by a flow control means. A loose change is maintained without changing sharply the pressure gradient from a pump room to a discharge port by this, and, as a result, the pulsation at the time of the regurgitation can be made small. And since flexibility can be given to maintenance of a loose change of a pressure gradient, a loose change of a pressure gradient can be adjusted finely and effectively, because a flow increases gradually.

[0029]In particular, according to claim 3 and the gear pump of an invention of four, it comes to be constituted by the flow control means fang furrow. Therefore, the structure of a flow control means is simplified and a flow control means can be formed simply and cheaply. In that case, since the conventional pump body and pump cover of a gear pump can be used especially, it is not necessary to newly manufacture the special parts for the gear pump of this invention, and they can be manufactured still more cheaply.

[0030]According to the gear pump of an invention of claim 5 thru/or 7, the flow of the hydraulic oil of either one of a body sewer and a covering sewer is set up become larger than the flow of the other of a body sewer and a covering sewer. Thereby, crushing of the air bubbles of the hydraulic oil of the pump interior of a room is increased in either one of a body sewer and a covering sewer, and it can do few on any of a body sewer and a covering sewer, or the other. Therefore, the influence of cavitation erosion becomes large in a direction with many flows of hydraulic oil the pump body of a casing, and among pump covers, and the influence of cavitation erosion becomes small in a direction with few flows of hydraulic oil. Thus, a cavitation can control distribution of the amount of energy given to a pump body and a pump cover, and can change the influence of cavitation erosion by the pump body and a pump cover.

[0031]According to the gear pump of an invention of claim 8, the inside of a pump body and a pump cover, The one where the influence of cavitation erosion is greater is formed by cavitation erosion-proof [high] material, such as cast iron, The one among a pump body and a pump cover where the influence of cavitation erosion is smaller is formed by cavitation erosion-proof [low] material, such as an aluminum material. Therefore, in a pump body and a pump cover, generating of the cavitation erosion by crushing of air bubbles can be more effectively controlled now. In that case, the tolerance over cavitation erosion can be improved by using high intensity and high hardness aluminum materials, such as high silicon, for cavitation erosion-proof [low] material.

[0032]Cavitation erosion-proof [high] material, such as cast iron, is used for either one of a pump body and a pump cover in this way, A pump body and a pump cover either by using cavitation erosion-proof [low] material, such as high intensity, high hardness aluminum materials, etc., such as for example, high silicon, for another side. Material costs are reducible while being able to reduce the part weight using cavitation erosion-proof [low] material, controlling cavitation erosion. Since it becomes possible to omit heat treatment to cavitation erosion-proof [low] material, such as an aluminum material, the installation cost for heat treatment can be excluded, moreover a man day can be reduced, and productivity can be made good.

[0033]Since a pump body or the plate of the same construction material as the construction material of a pump cover can be used for a drive gear and a driven gear, the degree of Takahira side of a plate can be

obtained and discharging performance can be improved. And since construction material of a pump body and a pump cover can be made the same, part mark are reducible.

[0034]According to the gear pump of an invention of claim 9, a pump body and a pump cover, . [whether it is formed to both cavitation erosion by the comparatively strong tolerant above-mentioned cavitation erosion-proof / high / material, and] Or a pump body and a pump cover are formed to both cavitation erosion by the tolerant comparatively weak above-mentioned cavitation erosion-proof [low] material.

[0035]Therefore, when both a pump body and a pump cover are formed by cavitation erosion-proof [high] material, It is made to what bears a pump body and a pump cover more certainly to both cavitation erosion conjointly that generating of the cavitation erosion by crushing of air bubbles can be controlled effectively. Thereby, the endurance of the gear pump to cavitation erosion can be improved.

[0036]By what cavitation erosion-proof [high] material is used for both a pump body and a pump cover for. Since a pump body or the plate of the same construction material as the construction material of a pump cover can be used for a drive gear and a driven gear, the degree of Takahira side of a plate can be obtained and discharging performance can be improved. And since construction material of a pump body and a pump cover can be made the same, part mark are reducible.

[0037]On the other hand, when both a pump body and a pump cover are formed by cavitation erosion-proof [low] material, Since generating of the cavitation erosion by crushing of air bubbles can be controlled effectively, even if it forms a pump body and a pump cover by cavitation erosion-proof [low] material, the influence of cavitation erosion can be inhibited. Thereby, the endurance of the gear pump to cavitation erosion can be improved.

[0038]Material costs are reducible while being able to reduce the part weight using cavitation erosion-proof [low] material by using cavitation erosion-proof [low] material for both a pump body and a pump cover, controlling cavitation erosion. Since it becomes possible to omit heat treatment to cavitation erosion-proof [low] material, such as an aluminum material, the installation cost for heat treatment can be excluded, moreover a man day can be reduced, and productivity can be made good.

[0039]Since the gear pump of this invention is conventionally used as a lubricating oil pump of gearboxes, such as a well-known automatic transmission and a nonstep variable speed gear, according to the gearbox of an invention of claim 10, While being able to improve the endurance of the gearbox which uses the lubricating oil pump, weight can be reduced, and moreover, it can manufacture cheaply.

[0040]

[Embodiment of the Invention]Hereafter, an embodiment of the invention is described using a drawing. . Drawing 1 shows an example of the embodiment of the gear pump of this invention, and (a) meets the shaft orientations which show selectively the state where it was used for the automatic transmission. the same fragmentary sectional view as drawing 7 (a) and (b) are the same figures (figure out of which omitted the pump cover 9 and the axis of rotation 12, and it came and which was specifically seen along the VIIB-VIIB line) as drawing 7 (b) seen along the IB-IB line (getting it blocked shaft orientations) in (a). The detailed explanation is omitted by giving the same numerals to the same component as the above-mentioned former.

[0041]As shown in drawing 1 (a) and (b), the gear pump 1 of this example, The pump gear 2 is constituted as an internal-gear pump which consists of a gear of the couple of the drive gear 3 which has the external tooth 3a, and the driven gear 4 which has the internal tooth 4a like the gear pump 1 shown in above-

mentioned drawing 7 (a) and (b).

[0042]In that case, in the gear pump 1 of this example, the pump body (O/P body) 8 is formed from cavitation erosion-proof [high] material, such as the above-mentioned cast iron which is comparatively tolerant to cavitation erosion. The pump cover (O/P covering) 9 is formed to cavitation erosion from cavitation erosion-proof [low] material, such as an aluminum material of tolerance lower than this cavitation erosion-proof [high] material. The tolerance over cavitation erosion can be improved by using high intensity and high hardness aluminum materials, such as high silicon, as cavitation erosion-proof [low] material.

[0043]As shown in drawing 2 (a), the releasing part 6b of the body side discharge port 6a is adjoined, and the body sewer 6c as a flow control means of this invention is established in the pump body (O/P body) 8. This body sewer 6c extends in linear shape in the rotation center axis, the diameter direction in a concentric circle, and direction crossing at a right angle of the drive gear 3, and as it is open for free passage to the body side discharge port 6a, it is established in it. In that case, the width and the depth of the body sewer 6c are set up quite smaller than the width and the depth of the body side discharge port 6a, respectively.

[0044]This body sewer 6c can also be formed circularly [the rotation center axis of the drive gear 3, and a concentric circle]. The body sewer 6c can also be established in the rotation center axis, the diameter direction in a concentric circle, and direction crossing at a right angle of the driven gear 4 circularly [the rotation center axis of linear shape or the driven gear 4, and a concentric circle].

[0045]On the other hand, as shown in drawing 3 (a), the releasing part 6e of 6 d of the covering side discharge ports is adjoined, and 6 f of covering sewers as a flow control means of this invention are established in the pump cover (O/P covering) 9. 6 f of this covering sewer extends in linear shape in the rotation center axis, the diameter direction in a concentric circle, and direction crossing at a right angle of the drive gear 3, and as it is open for free passage to 6 d of the covering side discharge ports, it is established in them. In that case, the width of 6 f of covering sewers and the depth are set up quite smaller than the width of 6 d of the covering side discharge ports, and the depth, respectively.

[0046]The length is shorter than the length of the body sewer 6c, and 6 f of covering sewers are set up, although the width and depth are set up similarly to the width of the body sewer 6c, and the depth, respectively. 6 f of this covering sewer can also be provided circularly [the rotation center axis of the drive gear 3, and a concentric circle]. 6 f of covering sewers can also be established in the rotation center axis, the diameter direction in a concentric circle, and direction crossing at a right angle of the driven gear 4 circularly [the rotation center axis of linear shape or the driven gear 4, and a concentric circle].

[0047]And when the pump body (O/P body) 8 fits into the crevice 9a of the pump cover (O/P covering) 9 clearly shown in drawing 2 (b) like the above-mentioned, As shown in drawing 1 (a), the gear chamber 11 is formed in the crevice 8a of the pump body (O/P body) 8 clearly shown in drawing 2 (b).

[0048]At this time, since the length of 6 f of covering sewers is set up shorter than the length of the body sewer 6c, As shown in drawing 1 (b), 6 f of all the covering sewers and a part of body sewer 6c consistent with shaft orientations substantially (opposite), and remainder $6c_1$ of the body sewer 6c is not adjusted to 6 f of covering sewers, and shaft orientations (opposite). Other composition of the gear pump 1 of this example is the same as the conventional gear pump 1 shown in above-mentioned drawing 7.

[0049]In the gear pump 1 of this example constituted in this way, The drive gear 3 and the driven gear 4 are [in / like the above-mentioned / drawing 1 (b)] counterclockwise rotations (in drawing 4). It rotates in alpha and the direction of beta, and as shown in (i) and (ii) of drawing 4 (a), the tooth point end 3b of the one

external tooth 3a of the drive gear 3 is located in the 1st opening point a which is a drive gear 3 hand-of-cut Mogami style end of the body sewer 6c. At this time, the pump room 13a of the drive gear 3 hand-of-cut upstream of this external tooth 3a is intercepted from the suction port 5, and hydraulic oil is confined in this pump room 13a.

[0050]In this state, if the drive gear 3 and the driven gear 4 rotate in the directions alpha and beta further, the tooth point end 3b of the external tooth 3a will move to a left in drawing 4 (a) from the 1st opening point a. Then, since the pump room 13a is open for free passage to the body sewer 6c and also it is open for free passage to the discharge port 6, the hydraulic oil confined in the pump room 13a flows into the discharge port 6 via the body sewer 6c.

[0051]Since an open flow area is dramatically small at this time since [according to / from the 1st opening point a of the tooth point end 3b of the external tooth 3a / in a free passage with the pump room 13a and the body sewer 6c / a shift to left], the flow of the hydraulic oil which flows out of the pump room 13a is small. Therefore, since the pressure gradient from the pump room 13a to the body sewer 6c is loose, the pulsation at the time of the regurgitation also becomes small.

[0052]Since these air bubbles will be wide opened by the body sewer 6c if the air bubbles (exhaust air) produced by the cavitation are in the pump room 13a, air bubbles come to be crushed by the high tolerant pump body 8 side to cavitation erosion.

[0053]If the drive gear 3 and the driven gear 4 rotate in the direction further, as shown in (i) and (ii) of drawing 4 (b), the tooth point end 4b of the one internal tooth 4a of the driven gear 4 is located in the 1st opening point a of the body sewer 6c. If the drive gear 3 and the driven gear 4 rotate in the direction further, the tooth point end 4b of the internal tooth 4a will move to a left in drawing 4 (b) from the 1st opening point a. Then, since a free passage with the pump room 13a and the body sewer 6c is performed by the shift to left from the 1st opening point a of the tooth point end 4b of the internal tooth 4a and an open flow area increases for a while, the flow of the hydraulic oil which flows out of the inside of the pump room 13a increases for a while.

[0054]Therefore, although a little pressure gradient from the pump room 13a to the body sewer 6c also increases, since a little pressure of the hydraulic oil in the pump room 13 is declining at this time, the pulsation at the time of the regurgitation seldom increases. Still more air bubbles in the pump room 13a come to be crushed by the pump body 8 side at this time.

[0055]If the drive gear 3 and the driven gear 4 rotate in the direction further, as shown in (i) and (ii) of drawing 4 (c), the tooth point end 3b of the external tooth 3a is located in the 2nd opening point b which is a drive gear 3 hand-of-cut Mogami style end which is 6f of covering sewers. If the drive gear 3 and the driven gear 4 rotate in the direction further, the tooth point end 3b of the external tooth 3a will move to a left in drawing 4 (c) from the 2nd opening point b. Then, since the pump room 13a is open for free passage to 6 f of covering sewers, the hydraulic oil in the pump room 13a flows into the discharge port 6 via the body sewer 6c and 6 f of covering sewers.

[0056]Since a free passage with the pump room 13a and 6 f of covering sewers is performed by the shift to left from the 2nd opening point b of the tooth point end 3b of the external tooth 3a at this time and an open flow area increases for a while further, the flow of the hydraulic oil which flows out of the pump room 13a increases for a while further.

[0057]Therefore, since the pressure of the hydraulic oil in the pump room 13 is declining for a while further at

this time, a pressure gradient is loose and the pulsation at the time of the regurgitation seldom increases. Although the air bubbles in the pump room 13a comes to be crushed [the pump cover 9 side], since it has farther than the flow of the hydraulic oil passing through 6 f of covering sewers many flows of the hydraulic oil passing through the body sewer 6c, there are many air bubbles crushed by the pump body 8 side, and there are few air bubbles crushed by the pump cover 9 side.

[0058]If the drive gear 3 and the driven gear 4 rotate in the direction further, as shown in (i) and (ii) of drawing 4 (d), the tooth point end 4b of the internal tooth 4a is located in the 2nd opening point b which is 6f of covering sewers. If the drive gear 3 and the driven gear 4 rotate in the direction further, the tooth point end 4b of the internal tooth 4a will move to a left in drawing 4 (d) from the 2nd opening point b. Then, since a free passage with the pump room 13a and 6 f of covering sewers is performed by the shift to left from the 2nd opening point b of the tooth point end 4b of the internal tooth 4a and an open flow area increases for a while further, the flow of the hydraulic oil which flows out of the pump room 13a increases for a while further.

[0059]Since the pressure of the hydraulic oil in the pump room 13 is declining for a while further also at this time, a pressure gradient is loose and the pulsation at the time of the regurgitation seldom increases. Since there are more flows of the hydraulic oil passing through the body sewer 6c than the flow of the hydraulic oil passing through 6 f of covering sewers, there are many air bubbles crushed by the pump body 8 side, and there are few air bubbles crushed by the pump cover 9 side.

[0060]If the drive gear 3 and the driven gear 4 rotate in the direction further, as shown in (i) and (ii) of drawing 4 (e), the tooth point end 3b of the external tooth 3a is located in the 3rd opening point c which are the releasing parts 6b and 6e of the discharge port 6. If the drive gear 3 and the driven gear 4 rotate in the direction further, the tooth point end 3b of the external tooth 3a will move to a left in drawing 4 (e) from the 3rd opening point b. Then, since the pump room 13a is open for free passage to the discharge port 6, the flow of the hydraulic oil which the hydraulic oil in the pump room 13a flows into the discharge port 6 also directly, and flows out of the pump room 13a increases further.

[0061]Since the pressure of the hydraulic oil in the pump room 13 is declining further also at this time, a pressure gradient is loose and the pulsation at the time of the regurgitation seldom increases. Since there are more flows of the hydraulic oil passing through the body sewer 6c than the flow of the hydraulic oil passing through 6 f of covering sewers, there are many air bubbles crushed by the pump body 8 side, and there are few air bubbles crushed by the pump cover 9 side.

[0062]If the drive gear 3 and the driven gear 4 rotate in the direction further, the tooth point end 4b of the internal tooth 4a is located in the 3rd opening point c which are the releasing parts 6b and 6e of the discharge port 6. If the drive gear 3 and the driven gear 4 rotate in the direction further, as shown in (i) and (ii) of drawing 4 (f), the tooth point end 4b of the internal tooth 4a will move to a left from the 3rd opening point c, and the pump room 13a will be open for free passage to the discharge port 6 also by the shift to left of the internal tooth 4a. For this reason, the flow area which the pump room 13a and the discharge port 6 open for free passage directly increases, and the flow of the hydraulic oil which flows out of the pump room 13a increases further.

[0063]Since the pressure of the hydraulic oil in the pump room 13a is declining further, at this time, a pressure gradient is loose, and the pulsation at the time of the regurgitation seldom increases at it. The air bubbles in the pump room 13 are almost crushed, there are still many air bubbles moreover crushed by the

pump body 8 side, and there are few air bubbles crushed by the pump cover 9 side. Thus, the body sewer 6c and 6 f of covering sewers constitute the flow control means of this invention.

[0064]Since according to the gear pump 1 of this example the length of the body sewer 6c is lengthened and the length of 6 f of covering sewers is shortened, the flow area which the pump room 13a and the discharge port 6 open for free passage can be increased gradually.Since the flow of the hydraulic oil which flows out of the pump room 13a into the discharge port 6 comes to increase gradually gradually with rotation of both the gears 3 and 4 by this, it is maintained gently, without changing a pressure gradient sharply, and, as a result, the pulsation at the time of the regurgitation can be made small.

[0065]And since flexibility can be given to maintenance of a loose change of a pressure gradient, a loose change of a pressure gradient can be adjusted finely and effectively, because a flow increases gradually.

[0066]The air bubbles of the many can be crushed by the pump body 8 side first formed by cavitation erosion-proof [high] material, such as cast iron, in the air bubbles intermingled in the hydraulic oil in the pump room 13a. The air bubbles crushed by this by the pump cover 9 side formed by cavitation erosion-proof [low] material, such as an aluminum material, can be lessened. Therefore, the influence of cavitation erosion can be changed in the pump body 8 and the pump cover 9. Thus, a cavitation can control distribution of the amount of energy given to the pump body 8 and the pump cover 9, and can change the influence of cavitation erosion by the pump body 8 and the pump cover 9. Therefore, in the pump body 8 and the pump cover 9, generating of the cavitation erosion by crushing of air bubbles can be effectively controlled now.

[0067]Generating of cavitation erosion from the ability to control effectively in this way. Cavitation erosion-proof [high] material, such as cast iron, can be used only for the pump body 8 like this example, and cavitation erosion-proof [low] material, such as a lightweight aluminum material, can be used now for the pump cover 9. Therefore, controlling cavitation erosion, even if it does not use cavitation erosion-proof [high] material, such as cast iron, for both the coverings 3 and 4. And material costs are reducible while being able to reduce the part weight which uses cavitation erosion-proof [low] material for the pump cover 9. And since it becomes possible to omit heat treatment to cavitation erosion-proof [low] material, such as an aluminum material, the installation cost for heat treatment can be excluded, moreover a man day can be reduced, and productivity can be made good.

[0068]Since the pump body 8 or the plate of the same construction material as the construction material of the pump cover 9 can be used for the drive gear 3 and the driven gear 4, the degree of Takahira side of a plate can be obtained and discharging performance can be improved. And since construction material of the pump body 8 and the pump cover 9 can be made the same, part mark are reducible.

[0069]By the way, the body sewer 6c and 6 f of covering sewers are not limited to the above-mentioned example, but similarly can also completely form the width, length, and the depth, and following various modification is also possible for them, for example. Drawing 5 (a) thru/or (e) is a figure showing the modification of the body sewer 6c and 6 f of covering sewers. In the example shown in drawing 5 (a), the width of the body sewer 6c is formed in width with the stage from small slot $6c_1$ and large slot $6c_2$. On the other hand, the width of 6 f of covering sewers is formed in constant width. In that case, while the width of small slot $6c_1$ and the width of 6 f of covering sewers are set as the same width, the length of the body sewer 6c and the length of 6f of covering sewer ** are set as the same length.

[0070]Therefore, if the pump body 8 and the pump cover 9 of this modification are combined as mentioned above, as shown in the right-hand side of drawing 5 (a), 6 f of all the covering sewers and a part of body sewer 6c consistent with shaft orientations (opposite), and the remainder (remainder of large slot $6c_2$) of the body sewer 6c is not adjusted to 6 f of covering sewers, and shaft orientations (opposite).

[0071]In the example shown in drawing 5 (b), the body sewer 6c is set up completely similarly to the example shown in drawing 5 (a). 6 f of covering sewers are set up for a long time [the length is shorter than the length of the body sewer 6c, and] than the length of large slot $6c_2$, although the width is set as the completely same width as the example shown in drawing 5 (a).

[0072]Therefore, if the pump body 8 and the pump cover 9 of this modification are combined as mentioned above, as shown in the right-hand side of drawing 5 (b), 6 f of all the covering sewers, a part of small slot $6c_1$ of the body sewer 6c, and a part of large slot $6c_2$ consistent with shaft orientations (opposite), and the remainder of small slot $6c_1$ and the remainder of large slot $6c_2$ do not consistent with 6 f of covering sewers, and shaft orientations (opposite).

[0073]Although the body sewer 6c is formed in width with the stage like the example shown in drawing 5 (a) in the example shown in drawing 5 (c), the length of small slot $6c_1$ and large slot $6c_2$ is set up for a long time than the length of small slot $6c_1$. The length is shorter than the length of large slot $6c_2$, and 6 f of covering sewers are set up, although the width is set as the completely same width as the example shown in drawing 5 (a).

[0074]Therefore, if the pump body 8 and the pump cover 9 of this modification are combined as mentioned above, as shown in the right-hand side of drawing 5 (c), 6 f of all the covering sewers and a part of large slot $6c_2$ of the body sewer 6c consistent with shaft orientations (opposite), and all of small slot $6c_1$ and the remainder of large slot $6c_2$ do not consistent with 6 f of covering sewers, and shaft orientations (opposite).

[0075]In both the examples shown in drawing 5 (d), the body sewer 6c and 6 f of covering sewers are formed in width with the stage. In that case, similarly the length of the body sewer 6c and the length of 6 f of covering sewers are set up. While the length of small slot $6c_1$ of the body sewer 6c is set up shorter than the length of large slot $6c_2$, the length of 6f of small slot $_1$ of 6 f of covering sewers is set up for a long time than the length of 6f of large slot $_2$. While the width of both small slot $6c_1$ and $6f_1$ is similarly set up mutually, similarly the width of both large slot $6c_2$ and $6f_2$ is also set up mutually.

[0076]Therefore, if the pump body 8 and the pump cover 9 of this modification are combined as mentioned above, as shown in the right-hand side of drawing 5 (d), 6 f of all the covering sewers, all of small slot $6c_1$ of the body sewer 6c, and a part of large slot $6c_2$ consistent with shaft orientations (opposite), and the remainder of large slot $6c_2$ does not consistent with 6 f of covering sewers, and shaft orientations (opposite).

[0077]In both the examples shown in drawing 5 (e), the body sewer 6c and 6 f of covering sewers are formed in width with the stage. In that case, the length of the body sewer 6c is set up for a long time than the length which is 6f of covering sewers. The length of large slot $6c_2$ of the body sewer 6c is set up shorter [it

is longer than the length of 6f of large slot $_2$ which is 6f of covering sewers, and] than the length of 6 f of covering sewers.

[0078]Therefore, if the pump body 8 and the pump cover 9 of this modification are combined as mentioned above, as shown in the right-hand side of drawing 5 (e), 6 f of all the covering sewers, a part of small slot $6c_1$ of the body sewer 6c, and a part of large slot $6c_2$ consistent with shaft orientations (opposite), and the remainder of small slot $6c_1$ and the remainder of large slot $6c_2$ do not consistent with 6 f of covering sewers, and shaft orientations (opposite). By such the body sewer 6c and 6 f of covering sewers of a modification, a operation effect substantially equivalent to the example shown in above-mentioned drawing 1 can be obtained.

[0079]In the gear pump 1 of each above-mentioned example, all, although the pars basilaris ossis occipitalis of the body side discharge port 6a, the releasing part 6b, and the pars basilaris ossis occipitalis of 6 d of the covering side discharge ports and the releasing part 6e are formed right-angled respectively mutually, As shown in drawing 6, the end by the side of the releasing part 6e of pars-basilaris-ossis-occipitalis $6d_1$ of the end by the side of the releasing part 6b of pars-basilaris-ossis-occipitalis $6a_1$ of the body side discharge port 6a, and 6 d of the covering side discharge ports, While forming in slope $6a_1$' and $6d_1$' so that it may become shallow gradually toward the releasing parts 6b and 6e, respectively, the body sewer 6c and 6 f of covering sewers can also be formed from the end of these slope $6a_1$' and $6d_1$', respectively.

[0080]The shape of the body sewer 6c of a modification and 6 f of covering sewers shown in drawing 5 can also be formed conversely mutually. Although the body sewer 6c and 6 f of covering sewers form in width with the stage in an above-mentioned example and modification, at least one slots [6c and 6f] width can also be set up become large continuously toward the discharge port 6. In this case, the flow of the hydraulic oil which flows out of the pump room 13a into the discharge port 6 comes to increase gradually continuously with rotation of both the gears 3 and 4.

[0081]In an above-mentioned example and modification, have provided so that at least a part of body sewers 6c and 6 f of covering sewers may be adjusted to shaft orientations (opposite), but. The formation position of the body sewer 6c and 6 f of covering sewers can be shifted to a diameter direction, and it can also provide so that these slots 6c and 6f may not be adjusted to shaft orientations at all (opposite).

[0082]Although not illustrated, the body sewer 6c and 6 f of covering sewers can change the depth of that mutually, or can also set it as the depth with the stage. That is, if a operation effect substantially equivalent to the example shown in above-mentioned drawing 1 can be obtained, the shape of the body sewer 6c and 6 f of covering sewers can be set also to how. Only those either can also provide the body sewer 6c and 6 f of covering sewers.

[0083]While forming the pump body 8 by cavitation erosion-proof [low] material, the pump cover 9 can also be formed by cavitation erosion-proof [high] material. Both the pump body 8 and the pump cover 9 can also be formed [both] by cavitation-proof [high] EROJI, and it can also form by cavitation-proof [low] EROJI.

[0084]As an automatic transmission selectively shown in drawing 1, The planetary gear unit which has two or more rotating elements although the whole is not shown in drawing 1 in detail, Two or more friction engagement elements which consist of a clutch which engages or stops two or more of these rotating elements, respectively, or a brake, By having the hydraulic control which supplies the oil pressure which

controlled the oil pressure supplied from the lubricating oil pump in the predetermined size to said friction engagement element, and carrying out the oil pressure control of engagement of said friction engagement element, and being un-engaged with hydraulic control. It automatic-changes gears, and the driving force from driving sources, such as an engine, is outputted, for example, a well-known automatic transmission can be conventionally used including the automatic transmission currently indicated by the above-mentioned publication before examination.

[0085]The gear pump 1 of this invention controls by hydraulic control the oil pressure supplied from the lubricating oil pump in a predetermined size, While it is applicable to the lubricating oil pump in the nonstep variable speed gear which carries out infinitely variable control of the driving force from driving sources, such as an engine, and outputs it with the oil pressure from this hydraulic control, It can use also for the owner stage or the stepless automatic or anti-full automatic gearbox which automated the start combined with a driving source, gear changes, or those both.

[0086]Thus, since the gear pump of above-mentioned this invention is used as a lubricating oil pump according to the automatic transmission of this invention, while being able to improve endurance, weight can be reduced and, moreover, it can manufacture cheaply.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]An example of the embodiment of the gear pump concerning this invention is shown, and (a) is a fragmentary sectional view along the shaft orientations which show selectively the state where it was used for the automatic transmission, and the figure which (b) looked at along the IB-IB line in (a).
[Drawing 2]It is a sectional view which shows the pump body (O/P body) of the casing in the gear pump of the example shown in drawing 1, and meets an IIB-IIB line [in / (a) can be set in a front view and / in (b) / (a)].
[Drawing 3]It is a sectional view which shows the pump cover (O/P covering) of the casing in the gear pump of the example shown in drawing 1, and meets an IIIB-IIIB line [in / (a) can be set in a front view and / in (b) / (a)].
[Drawing 4]It is a sectional view showing typically other examples of the embodiment of the gear pump concerning this invention.
[Drawing 5](a) Or (e) is a figure showing the modification of a body sewer and a covering sewer.
[Drawing 6]It is a sectional view showing the modification of the gear pump concerning this invention typically and selectively.
[Drawing 7]An example of the conventional gear pump is shown and (a) is a fragmentary sectional view along the shaft orientations which show selectively the state where it was used for the automatic transmission, and the figure which (b) looked at along the VIIB-VIIB line in (a).
[Drawing 8]The figure showing the pump body (O/P body) of the casing in the gear pump of the conventional example which shows drawing 7 (a), and (b) are the figures showing the pump cover (O/P covering) of the casing in the gear pump of the conventional example shown in drawing 7.
[Description of Notations]
1 [-- External tooth,] -- A gear pump, 2 -- A pump gear, 3 -- A drive gear, 3a 4 [-- A suction port, 5a / -- Body side suction port,] -- A driven gear, 4a -- An internal tooth, 4b -- An external tooth, 5 5b [-- A body sewer, 6d / -- The covering side discharge port, 6f / -- A covering sewer, 8 / -- A pump body (O/P body), 9 / -- A pump cover (O/P covering), 10 / -- A casing, 11 / -- A gear chamber, 13 / -- Pump room] -- The covering side suction port, 6 -- A discharge port, 6a -- The body side discharge port, 6c

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]A suction port, a gear chamber, and a casing in which a discharge port was formed.
A gear of a couple by which it gears to a gear chamber of this casing that it is pivotable respectively and mutually, and is allocated in it, and a pump room is formed in each adjoining interdentium.
It is the gear pump provided with the above, and a flow control means which increases hydraulic fluid of said pump room gradually with a flow of hydraulic fluid which flows into said discharge port to rotation of a gear of said couple is established.

[Claim 2]A gear pump indicated to claim 1 comprising a driven gear characterized by comprising the following.
A drive gear on which a gear of said couple has an external tooth.
An internal tooth which carries out eccentricity, and is provided from this drive gear, and gears to said external tooth.

[Claim 3]Said casing consists of a pump body and a pump cover which are put together mutually and form said gear chamber, Said discharge port consists of a body side discharge port established in said pump body, and a covering side discharge port established in said pump cover, and said flow control means, A gear pump indicated to claim 1 or 2 comprising a slot which is established in either one of said pump body and said pump cover, and is open for free passage to either one of said body side discharge port and said covering side discharge port.
[Claim 4]Said casing consists of a pump body and a pump cover which are put together mutually and form said gear chamber, Said discharge port consists of a body side discharge port established in said pump body, and a covering side discharge port established in said pump cover, and said flow control means, A gear pump indicated to claim 1 or 2 comprising a body sewer which is established in both said pump body and said pump cover, respectively, and is open for free passage to said body side discharge port and said covering side discharge port, respectively, and a covering sewer.
[Claim 5]A gear pump indicated to claim 4 setting up so that a flow of hydraulic oil of either one of said body sewer and said covering sewer may become larger than a flow of the other of said body sewer and said covering sewer.
[Claim 6]A gear pump indicated to claim 5 statement, wherein each width of said body sewer and said

covering sewer is both set up more narrowly than width of said discharge port end.

[Claim 7]Said body sewer and said covering sewer, respectively from a hand-of-cut upstream end of a gear of said couple of said body side discharge port, and said hand-of-cut upstream end of said covering side discharge port. Are provided so that it may extend in said hand-of-cut upstream, and said body side discharge port and said covering side discharge port, the state where said pump body and said pump cover were put together -- those -- it being provided so that a hand-of-cut upstream portion of a gear of said couple may consistent with shaft orientations mutually at least, and, Said body sewer and said covering sewer of the length of either one of said body sewer and said covering sewer are the gear pumps indicated to claim 5 or 6 setting up shorter than the length of the other either.

[Claim 8]Either one of said pump body and said pump cover is formed to cavitation erosion by cavitation erosion-proof [high] material, such as comparatively strong tolerant cast iron, Said pump body and said pump cover are the gear pumps indicated to any 1 of claims 3 thru/or 7 forming another side to cavitation erosion by cavitation erosion-proof [low] material, such as a tolerant comparatively weak aluminum material, either.

[Claim 9]. [whether said pump body and said pump cover are formed to both cavitation erosion by cavitation erosion-proof / high / material, such as comparatively strong tolerant cast iron, and] Or a gear pump indicated to any 1 of claims 3 thru/or 7 forming said pump body and said pump cover to both cavitation erosion by cavitation erosion-proof [low] material, such as a tolerant comparatively weak aluminum material.

[Claim 10]In [control by hydraulic control oil pressure supplied from a lubricating oil pump in a predetermined size, and] automatic transmission control or a gearbox which carries out infinitely variable control and is outputted driving force from driving sources, such as an engine, with oil pressure from this hydraulic control, A gearbox which carries out the feature of said lubricating oil pump comprising a gear pump of any 1 statement of claims 1 thru/or 7.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

WRITTEN AMENDMENT

---------- [Written amendment]
[Filing date]December 5, Heisei 14 (2002.12.5)
[Amendment 1]
[Document to be Amended]Specification
[Item(s) to be Amended]Claim
[Method of Amendment]Change
[Proposed Amendment]
[Claim(s)]
[Claim 1]It has at least a pump gear which consists of a gear of a couple by which it gears to a gear chamber of a suction port, a gear chamber and a casing in which a discharge port was formed, and this casing that it is pivotable respectively and mutually, and is allocated in it, and a pump room is formed in each adjoining interdentium,
In a gear pump which inhales hydraulic fluid from said suction port to said pump room because a gear of said couple rotates, and carries out the regurgitation of the hydraulic fluid of said pump room from said discharge port,
A flow control means which increases hydraulic fluid of said pump room gradually with a flow of hydraulic fluid which flows into said discharge port to rotation of a gear of said couple is established,
A gear pump, wherein said flow control means is provided with a slot which is open for free passage to said discharge port.
[Claim 2]A gear pump indicated to claim 1 comprising a driven gear characterized by comprising the following.
A drive gear on which a gear of said couple has an external tooth.
An internal tooth which carries out eccentricity, and is provided from this drive gear, and gears to said external tooth.

[Claim 3]A gear pump indicated to claim 1 or 2, wherein width of said slot is set up more narrowly than width of said discharge port end.
[Claim 4]A gear pump indicated to any 1 of claims 1 thru/or 3 by which it is forming [a releasing part side edge part of a pars basilaris ossis occipitalis of said discharge port / so that it may become shallow gradually

toward the releasing part / in a slope] characterized.

[Claim 5]Said casing consists of a pump body and a pump cover which are put together mutually and form said gear chamber,

Said discharge port consists of a body side discharge port established in said pump body, and a covering side discharge port established in said pump cover,

A gear pump indicated to any 1 of claims 1 thru/or 4, wherein said slot is at least one side of a slot which is established in a slot which is established in said pump body and is open for free passage to said body side discharge port, and said pump cover, and is open for free passage to said covering side discharge port.

[Claim 6]A gear pump indicated to claim 5 setting up so that a flow of hydraulic oil of either one of said body sewer and said covering sewer may become larger than a flow of the other of said body sewer and said covering sewer.

[Claim 7]From a hand-of-cut upstream end of a gear of said couple of said body side discharge port, and said hand-of-cut upstream end of said covering side discharge port, said body sewer and said covering sewer are provided, respectively so that it may extend in said hand-of-cut upstream,

said body side discharge port and said covering side discharge port are in a state where said pump body and said pump cover were put together -- those -- being provided so that a hand-of-cut upstream portion of a gear of said couple may consistent with shaft orientations mutually at least

Said body sewer and said covering sewer of the length of either one of said body sewer and said covering sewer are the gear pumps indicated to claim 5 or 6 setting up shorter than the length of the other either.

[Claim 8]Either one of said pump body and said pump cover is formed to cavitation erosion by cavitation erosion-proof [high] material, such as comparatively strong tolerant cast iron, Said pump body and said pump cover are the gear pumps indicated to any 1 of claims 3 thru/or 7 forming another side to cavitation erosion by cavitation erosion-proof [low] material, such as a tolerant comparatively weak aluminum material, either.

[Claim 9]. [whether said pump body and said pump cover are formed to both cavitation erosion by cavitation erosion-proof / high / material, such as comparatively strong tolerant cast iron, and] Or a gear pump indicated to any 1 of claims 3 thru/or 7 forming said pump body and said pump cover to both cavitation erosion by cavitation erosion-proof [low] material, such as a tolerant comparatively weak aluminum material.

[Claim 10]Oil pressure supplied from a lubricating oil pump is controlled by hydraulic control in a predetermined size, and driving force from driving sources, such as an engine, is set with oil pressure from this hydraulic control to automatic transmission control or a gearbox which carries out infinitely variable control and is outputted,

A gearbox which carries out the feature of said lubricating oil pump consisting of a gear pump indicated to any 1 of claims 1 thru/or 7.

[The amendment 2]

[Document to be Amended]Specification

[Item(s) to be Amended]0018

[Method of Amendment]Change

[Proposed Amendment]

[0018]

[Means for Solving the Problem]In order to solve the above-mentioned technical problem, a gear pump of an invention of claim 1, A suction port, a gear chamber, and a casing in which a discharge port was formed, It has at least a pump gear which consists of a gear of a couple by which it gears to a gear chamber of this casing that it is pivotable respectively and mutually, and is allocated in it, and a pump room is formed in each adjoining interdentium, In a gear pump which inhales hydraulic fluid from said suction port to said pump room because a gear of said couple rotates, and carries out the regurgitation of the hydraulic fluid of said pump room from said discharge port, A flow control means which increases hydraulic fluid of said pump room gradually with a flow of hydraulic fluid which flows into said discharge port to rotation of a gear of said couple is established, and said flow control means is characterized by having a slot which is open for free passage to said discharge port.

[Amendment 3]

[Document to be Amended]Specification

[Item(s) to be Amended]0020

[Method of Amendment]Change

[Proposed Amendment]

[0020]The invention of claim 3 is characterized by setting up the width of said slot more narrowly than the width of said discharge port end.

[Amendment 4]

[Document to be Amended]Specification

[Item(s) to be Amended]0021

[Method of Amendment]Change

[Proposed Amendment]

[0021]The invention of claim 4 is taken as the forming [the releasing part side edge part of the pars basilaris ossis occipitalis of said discharge port / in a slope] feature so that it may become shallow gradually toward the releasing part.

[Amendment 5]

[Document to be Amended]Specification

[Item(s) to be Amended]0022

[Method of Amendment]Change

[Proposed Amendment]

[0022]The invention of claim 5 consists of the pump body and pump cover which said casing is put together mutually and form said gear chamber, Said discharge port consists of a body side discharge port established in said pump body, and a covering side discharge port established in said pump cover, It is characterized by being at least one side of the slot which said slot is established in the slot which is established in said pump body and is open for free passage to said body side discharge port, and said pump cover, and is open for free passage to said covering side discharge port.

[Amendment 6]

[Document to be Amended]Specification

[Item(s) to be Amended]0023

[Method of Amendment]Change

[Proposed Amendment]

[0023]The invention of claim 6 is characterized by being set up so that the flow of the hydraulic oil of either one of said body sewer and said covering sewer may become larger than the flow of the other of said body sewer and said covering sewer.

[Amendment 7]

[Document to be Amended]Specification

[Item(s) to be Amended]0029

[Method of Amendment]Change

[Proposed Amendment]

[0029]Since it is especially constituted by the flow control means fang furrow, the structure of a flow control means is simplified and a flow control means can be formed simply and cheaply. In that case, since the conventional pump body and pump cover of a gear pump can be used especially, it is not necessary to newly manufacture the special parts for the gear pump of this invention, and they can be manufactured still more cheaply.

[Amendment 8]

[Document to be Amended]Specification

[Item(s) to be Amended]0030

[Method of Amendment]Change

[Proposed Amendment]

[0030]According to claim 6 and the gear pump of an invention of seven, the flow of the hydraulic oil of either one of a body sewer and a covering sewer is set up become larger than the flow of the other of a body sewer and a covering sewer. Thereby, crushing of the air bubbles of the hydraulic oil of the pump interior of a room is increased in either one of a body sewer and a covering sewer, and it can do few on any of a body sewer and a covering sewer, or the other. Therefore, the influence of cavitation erosion becomes large in a direction with many flows of hydraulic oil the pump body of a casing, and among pump covers, and the influence of cavitation erosion becomes small in a direction with few flows of hydraulic oil. Thus, a cavitation can control distribution of the amount of energy given to a pump body and a pump cover, and can change the influence of cavitation erosion by the pump body and a pump cover.

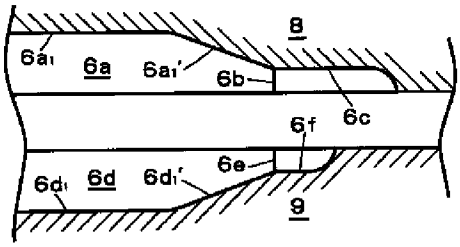
[Translation done.]

* NOTICES *

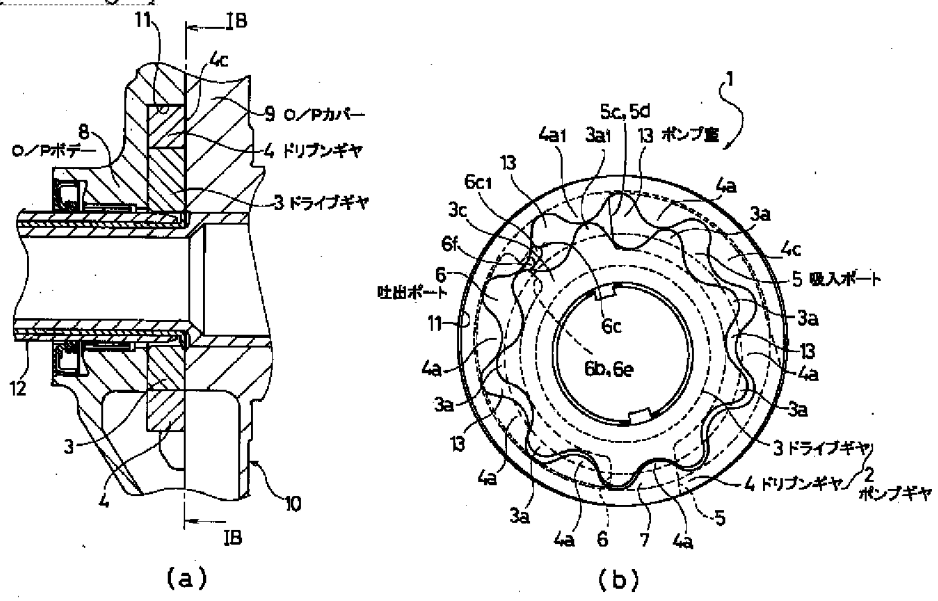
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

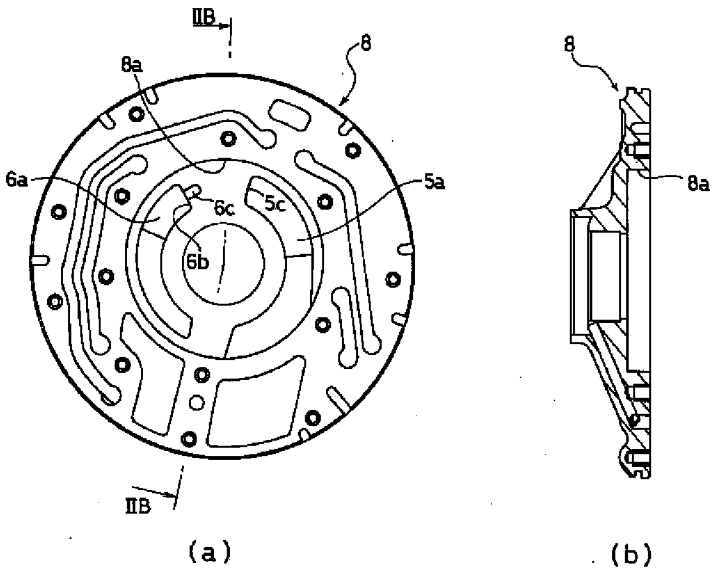
[Drawing 6]



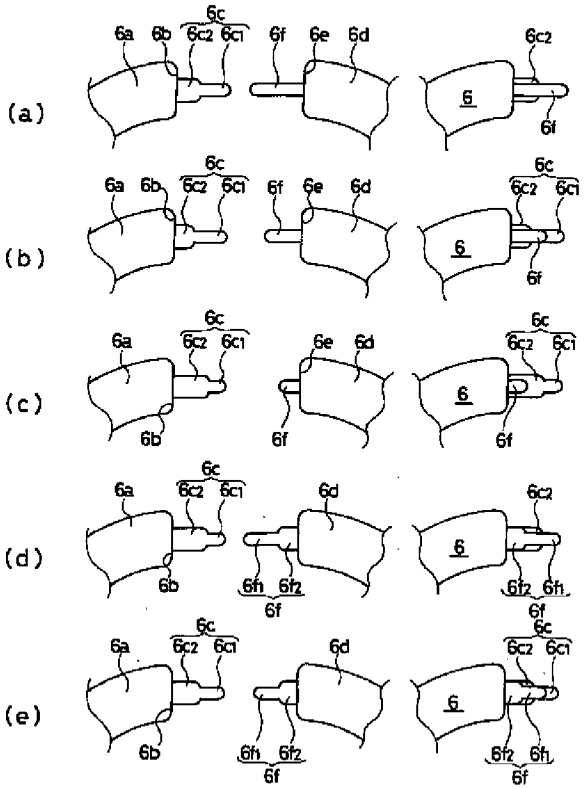
[Drawing 1]



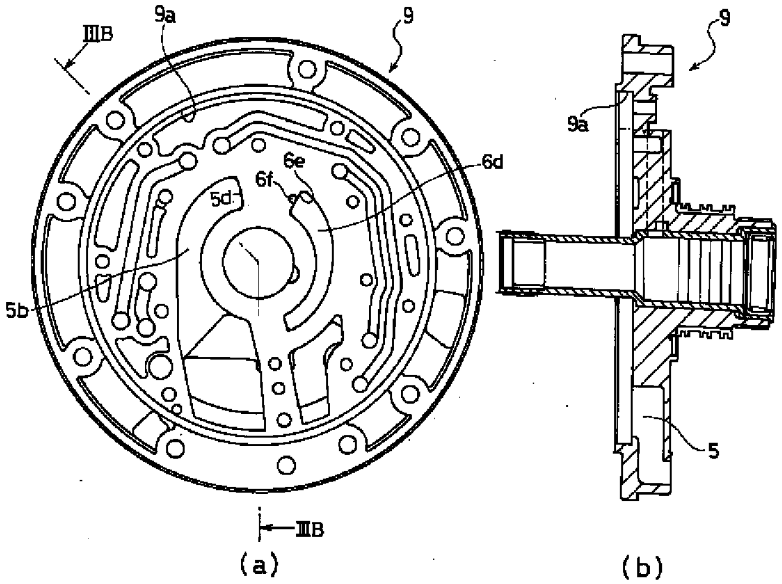
[Drawing 2]



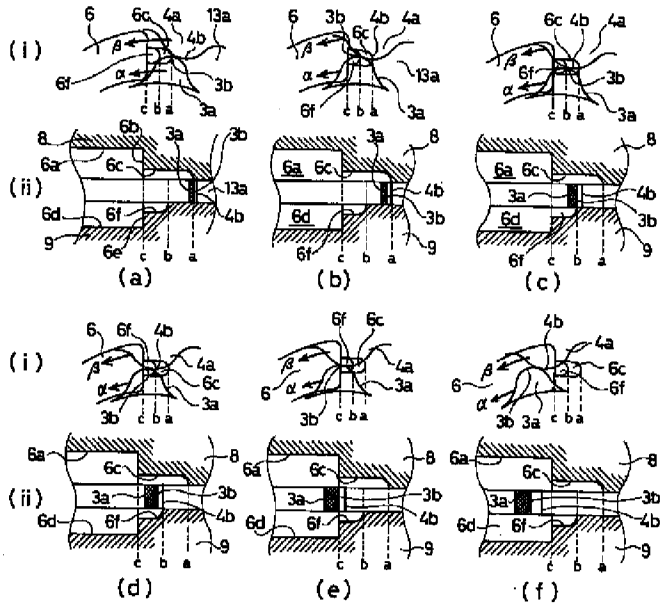
[Drawing 5]



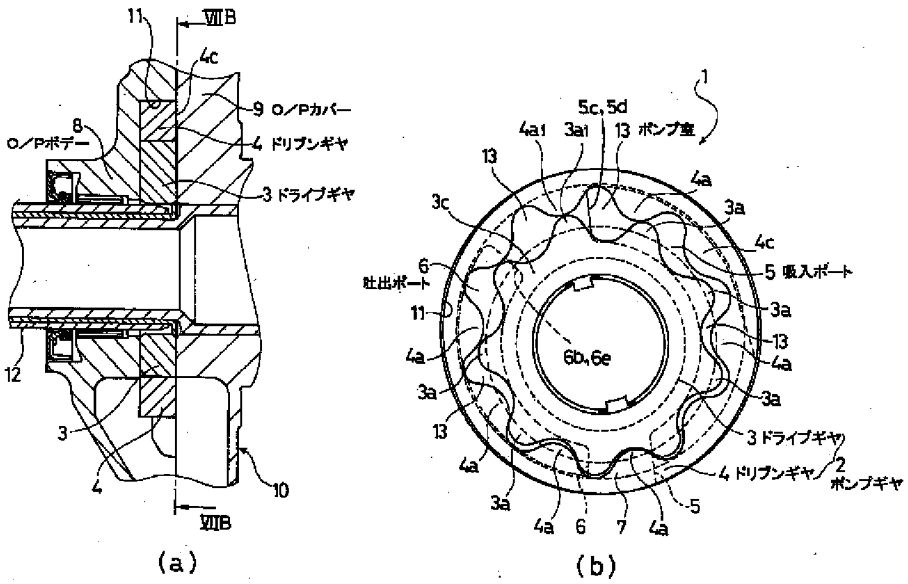
[Drawing 3]



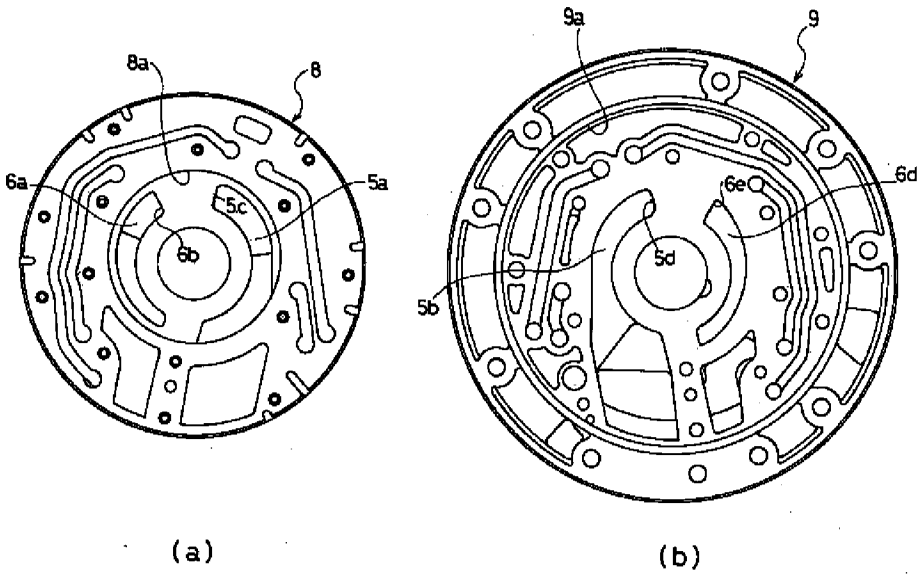
[Drawing 4]



[Drawing 7]



[Drawing 8]



[Translation done.]